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The Genus *Sophiothrips* HOOD (Thysanoptera, Phlaeothripidae) from Japan

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Abstract The Japanese species of the phlaeothripid genus *Sophiothrips* are studied. Three species are recognized, two of them being new to science: *Sophiothrips annulatus* sp. nov. from the Ryukyu Islands and *S. decorus* sp. nov. from the Ogasawara Islands. They seem to be fungus-feeders, being found on dead leaves and branches, on grasses, on dead Palmae fronds or in leaf-litter. A key is provided to these three Japanese species.

Key words: Thysanoptera; Phlaeothripidae; Hoplothripina; *Sophiothrips*; Japan.

The genus *Sophiothrips* HOOD belongs to the subfamily Phlaeothripinae of the family Phlaeothripidae, and MOUND (1989) treated it in the subtribe Hoplothripina of the tribe Hoplothripini, though it had been included in the subtribe Williamsiellina of the same tribe till then. The males of the genus have the reticulated areas on the intermediate abdominal sterna, and this feature is also found in the genus *Hoplothrips* (cf. OKAJIMA, 1989). The characters defining this genus are the short head (cf. Fig. 1), extremely short maxillary stylets and well developed sixth antennal segments (Figs. 8–9). The members of the genus seem to be the fungus-feeders, and being found on dead leaves and branches, on grasses, on Palmae fronds, or in leaf-litter. Up to the present time, only one species, *S. nigrus* ANANTHAKRISHNAN, has been known from Japan. Recently, however, the author examined many specimens collected from the Ryukyu and the Ogasawara Islands, and three species including two new to science are recognized from Japan.

Type depository. Two holotypes and most paratypes designated in this paper are preserved in the Laboratory of Entomology, Tokyo University of Agriculture.

Abbreviations. The following abbreviations are used for the collectors: SO, S. OKAJIMA; TN, T. NONAKA.

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Genus *Sophiothrips* HOOD

- Sophiothrips* HOOD, 1933, 425–426. Type species: *Sophiothrips squamosus* HOOD, by monotypy; MOUND & WALKER, 1982, 349.
- Nanothrips* FAURE, 1938, 3. Type species: *Nanothrips breviceps* FAURE, by monotypy. (Synonymized by HOOD, 1954).
- Zaxenothrips* CRAWFORD, 1943, 221–224. Type species: *Zaxenothrips peculiaris* CRAWFORD, by monotypy. (Synonymized by HOOD, 1954).
- Bagnalliola* PRIESNER, 1949, 95. Type species: *Brachythrips terminalis* BAGNALL, by monotypy. (Synonymized with *Nanothrips* by MOUND, 1977).
- Nanimothrips* ZUR STRASSEN, 1974, 120–123. Type species: *Nanimothrips makaronesicus* ZUR STRASSEN, by monotypy. (Synonymized with *Nanothrips* by MOUND, 1977).

This genus belongs to the subtribe Hoplothripina of the tribe Hoplothripini, and its relationships had been discussed by MOUND and WALKER (1982) and MOUND (1989). There are 25 species in *Sophiothrips* in the World including two new species described below, and MOUND and WALKER (1982) divided this genus into six species-groups. According to it, all Japanese species are placed in the *breviceps*-group. Twelve Old World species are now placed in this group, and they have only one sense-cone (rarely none) on the third antennal segment and foretarsal tooth in female.

Three species are now recognized in the genus from Japan.

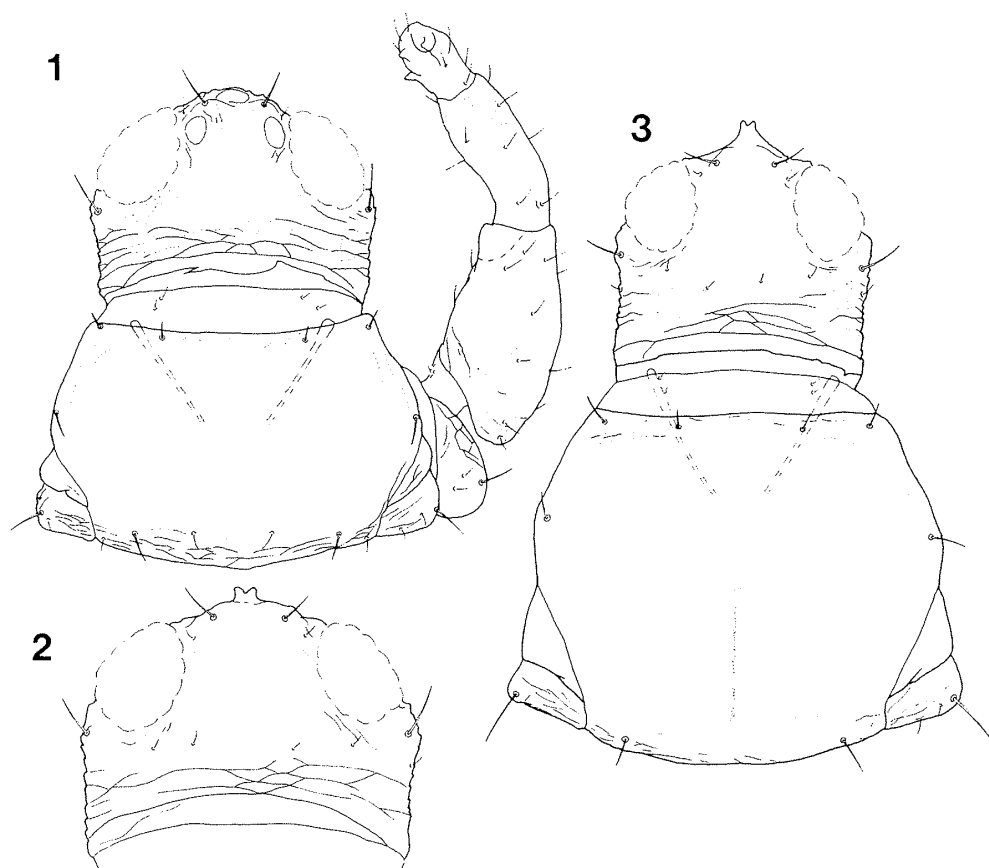
Key to Japanese Species

1. Bicolourous dark brown and yellow, head and abdominal segments VII to X (=tube) yellow; margins of pronotum, metanotum and terga II and III distinctly reticulated; antennal segments III to V each with a pair of short and blunt dorsal setae *Sophiothrips decorus* sp. nov.
- Uniformly dark brown or yellowish brown; pronotum smooth, metanotum and terga II and III reticulated, but weak; antennal segments III to V with long and pointed dorsal setae 2
2. Body smaller, distended length usually less than 1300 μm ; antennal segment III with subbasal annular expansion (Fig. 8); sides of tube rather straight, but constricted at apex *Sophiothrips annulatus* sp. nov.
- Body larger, distended length usually more than 1400 μm ; antennal segment III without subbasal expansion; tube straight-sided, not constricted at apex *Sophiothrips nigrus* ANANTHAKRISHNAN

Sophiothrips annulatus sp. nov.

(Figs. 1–3, 8, 10–12)

Female (macroptera). Head, thorax and abdominal segments I to IX dark brown; tube somewhat yellowish, with extreme apex dark; all femora and mid- and hindtibiae dark brown with apical third yellowish, foretibiae yellow, shaded with



Figs. 1–3. *Sophiothrips annulatus* sp. nov. — 1, Head, prothorax and right foreleg, macropterous female; 2, head, apterous female; 3, head and prothorax, apterous male.

brown to dark brown at basal two-thirds of inner side, tarsi yellow; antennal segments I and II yellow, segments III to VII yellow at basal halves, shaded with brown at apical halves, segment VIII brown; forewings shaded with pale brown; major body setae yellowish.

Head (Fig. 1) 1.60–1.65 times as broad as long, cheeks swollen just behind eyes, dorsal surface sculptured posteriorly with transverse striae; a pair of ocellar setae blunt or nearly pointed at apices, their distance $29\ \mu\text{m}$ in holotype; postocular setae blunt or almost pointed at apices. Eyes 0.58 times as long as head; ocelli well developed, posterior pair in contact with eyes, $28\ \mu\text{m}$ apart from each other in holotype. Antennae (Fig. 8) about three times as long as head; segment III with subbasal annular expansion, with one outer sense-cone (0+1); length/width of segments=III 1.40, IV 1.25, V 1.29, VI 1.69, VII+VIII 2.49 in holotype.

Pronotum (Fig. 1) typical of the genus, 1.27 times as long as head, 1.66 times as broad as long in holotype; anteromarginal setae reduced to minute setae, other usual setae comparatively short, blunt or pointed at apices; notopleural sutures complete or nearly complete. Foretarsal tooth minute. Metanotum weakly

sculptured with incomplete reticulation, with two pairs of short median setae. Forewings each with two short subbasal setae.

Pelta (Fig. 10) hat-shaped, with a pair of distinct campaniform sensillae, their distance 44 μm in holotype. Terga III and IV slightly reduced in length medially; B1 setae on tergum IX about three-fourths the length of tube, longer than B2, sharply pointed at apices; B2 setae stouter than B1, blunt at apices. Tube 1.19 times as long as head, 1.77 times as long as basal width in holotype; surface weakly sculptured with reticulation; sides rather straight, but constricted at apex.

Measurements of holotype macropterous female in μm . Total distended body length 1250. Head whole length 91, length from anterior margin of eyes 82, width 148; eye length 53, width 42. Pronotum median length 116, width 193; forewing length 552. Pelta median length 53, width 187. Tube length 108, basal width 61, apical width 29. Antenna total length 280; segments I to VII+VIII length (width) as follows: 32 (29); 34 (32); 37 (26.5); 37 (29.5); 40 (31); 50 (29.5); 46 (18.5).

Length of setae. Ocellars 19–21; postoculars 26–29. Prothoracic anteromarginals less than 8, anteroangulars and midlaterals about 10, posteroangulars about 15, epimerals 24–30. Setae on tergum IX: B1 79–82, B2 65–66. Anals 35–40.

Female (aptera). Colour almost as in macropterous female. Head (Fig. 2) with small eyes, ocelli absent; mesopraesternum reduced; pelta (Fig. 11) broadly trapezoidal, with distinct transverse striae at near posterior margin, 65–72 μm apart from each campaniform sensilla; tube 1.54–1.56 times as long as basal width.

Measurements of paratype apterous female in μm . Total distended body length 1250. Head whole length 98, length from anterior margin of eyes 84, width 137; eye length 45, width 40. Pronotum median length 134, width 197. Pelta median length 39, width 190. Tube length 102, basal width 66, apical width 28. Antenna total length 284; segments I to VII+VIII length (width) as follows: 31.5 (31); 37 (34); 40 (29); 37 (31.5); 40 (31.5); 50 (30); 48 (18).

Length of setae. Ocellars about 20; postoculars about 30. Prothoracic anteroangulars ? about 10, anteromarginals less than 10, midlaterals ? about 20, posteroangulars 20–22, epimerals 29–32. Setae on tergum IX: B1 75–79, B2 58. Anals 43–45.

Male (aptera). Colour almost as in macropterous female. Head (Fig. 3) 1.10–1.32 times as broad as long, with a tubercle ventrally between eyes, but the tubercle absent in small male; length/width of antennal segments (small-large)=III 1.37–1.38, IV 1.13–1.25, V 1.12–1.41, VI 1.54–1.76, VII+VIII 2.44–2.62; prothorax (Fig. 3) distinctly developed and foretarsal tooth stout in large male; pelta widely hat-shaped in small male, widely trapezoidal (Fig. 12) with anterior margin rounded in large male; tergum IX without median tubercle; tube slightly widened basally.

Measurements of small-large paratype apterous males in μm . Total distended body length 807–1135. Head whole length 76–107, length from anterior margin of eyes 61–86, width 100–118; eye length 33–45, width 26–35. Pronotum median length 87–158, width 148–190. Pelta median length 30–40, width 143–167. Tube length

74–98, basal width 50–61, apical width 23–26. Antenna total length 220–282; segments I to VII+VIII length (width) as follows: 24–31.5 (24–28); 29–35 (27.5–31.5); 31.5–36.5 (23–26.5); 27–34.5 (24–27.5); 29–38 (26–27); 40–47.5 (26–27); 39–44.5 (16–17).

Length of setae. Ocellars 16–24; postoculars 18–25. Prothoracic posteroangulars 13–26, epimerals 18–32. Setae on tergum IX: B1 79–80, B2 23–24. Anals 42–44.

Holotype ♀ (mac.). Japan, Ryukyu Isls., Ishigaki-jima Is, Mt. Banna-dake, on dead leaves and branches, 17–viii–1989, (TN et SO).

Paratypes. Japan, Ryukyu Isls., Ishigaki-jima Is.: 1 ♀ (apt.), Mt. Banna-dake, on dead *Arenga engleri* frond (Palmae), 10–ix–1988, (SO); Urasoko-noudou, 2 km from Hoshino, on dead branches, 1 ♀ (apt.), 13–ix–1989, (TN et SO), 2 ♀ (apt.), 21–iii–1990, (TN), 7 ♀ 1 ♂ (apt.), 28–iii–1990, (TN); nr. Nagura, Takeda, on dead branches, 1 ♀ (mac.) 3 ♀ 1 ♂ (apt.), 7–ix–1989, (TN et SO), 3 ♀ (mac.) 12 ♀ 4 ♂ (apt.), 13 to 14–ix–1989, (SO), 1 ♀ (apt.), 11–iii–1990, (TN), 2 ♀ 1 ♂ (apt.), 11–i–1991, (SO); 1 ♀ (apt.), Tropic. Agr. Res. Ctr. Yaeyama Branch, on dead *Casuarina* branches, 31–iii–1990, (TN), 1 ♀ (apt.), Mt. Yarabu-dake, on dead leaves and branches, 20–iii–1990, (TN); 1 ♀ (apt.), Mt. Omoto-dake, on dead leaves and branches, 13–iii–1990, (TN).

Distribution. Japan—Ryukyu Islands (Ishigaki-jima Is.).

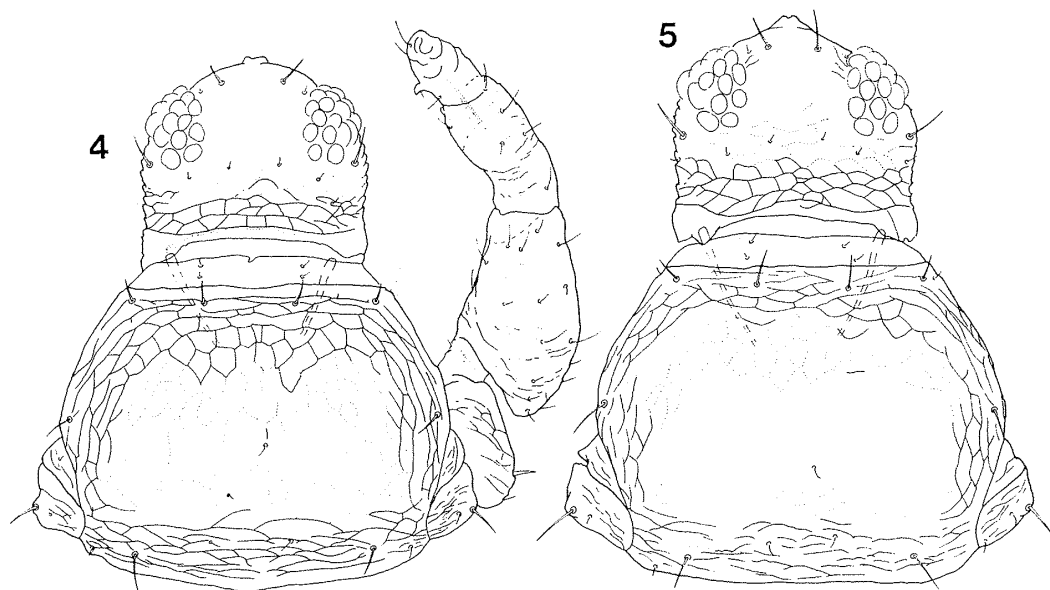
Comments. This species belongs to the group with one sense-cone on the third antennal segment and without median tubercle on the ninth abdominal tergum in male, and it is very similar to sympatric species, *nigrus*, in general appearance. However, it can easily be distinguished from *nigrus* by the following features: Body smaller, usually less than 1300 µm; antennal segment III with annular expansion subbasally (Fig. 8); tube constricted at apex.

Sophiothrips decorus sp. nov.

(Figs. 4–7, 9, 13–14)

Female (aptera). Bicolourous yellow and dark brown; head, legs, abdominal segments VII to IX and tube yellow, but basal collar of head, basal third of mid- and hindfemora and posterior third of abdominal segment VIII shaded with dark brown, forefemora shaded with pale brown basally; thorax and abdominal segments I (=pelta) to IV dark brown; abdominal segment V dark brown, but a little paler than segment IV, segment VI brown, paler than segment V; antennal segments I to III yellow, segments IV and V yellow with pale brown shadings, segment VI pale brown, with basal third yellow, segments VII and VIII brown; all major setae yellowish.

Head (Fig. 4) 1.27–1.29 times as broad as long; cheeks weakly rounded, widened basally; dorsal surface distinctly reticulated posteriorly; a pair of ocellar setae well developed, blunt at apices, their distance 34 µm in holotype; postocular setae blunt



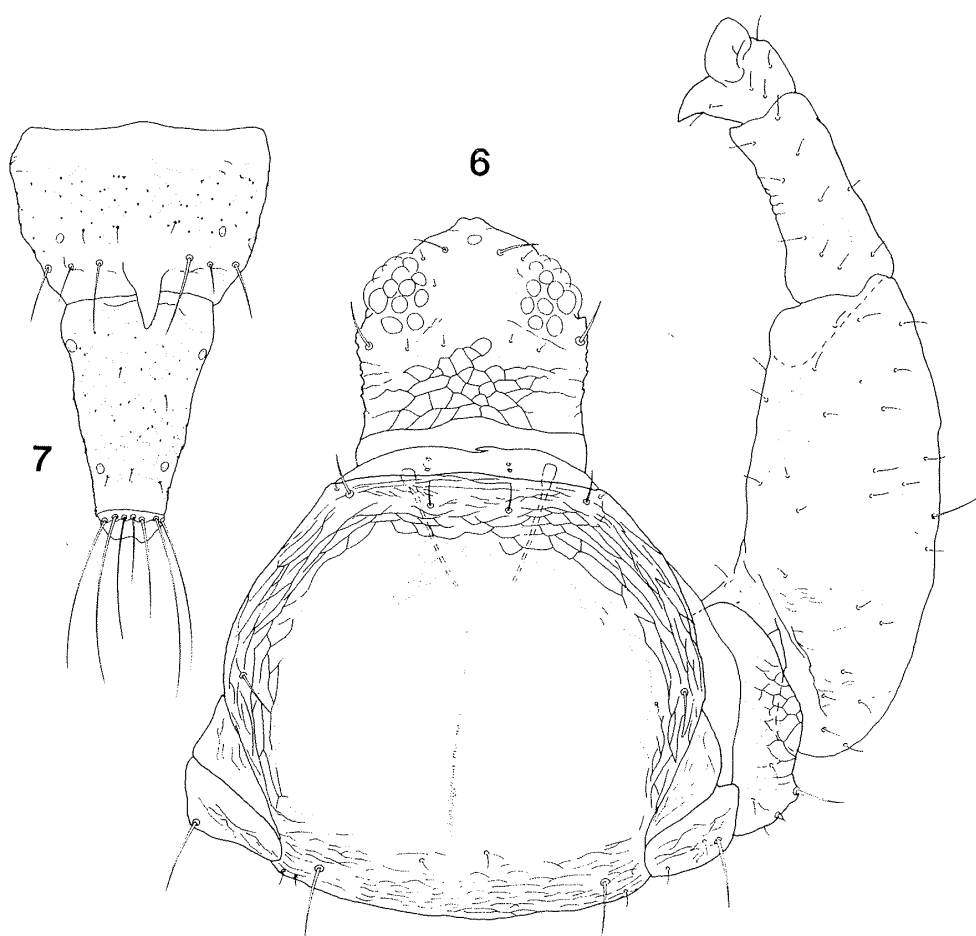
Figs. 4-5. *Sophiothrips decorus* sp. nov., apterae. — 4, Head, prothorax and right foreleg, female; 5, head and prothorax, small male.

at apices. Eyes 0.46 times as long as head, ommatidia more or less separated from one another; ocelli absent. Antennae (Fig. 9) 2.84 times as long as head; segment III with outer one sense-cone (0+1), with annular expansion subbasally; dorsal pair of setae on segments II to IV short and blunt at apices; length/width of segments=III 1.53, IV 1.13, V 1.19, VI 1.52, VII+VIII 2.43 in holotype.

Prothorax (Fig. 4) well developed; pronotum distinctly reticulated marginally, indistinctly reticulated medially; anteroangular, anteromarginal, midlateral and posteroangular setae short and pointed, epimeral setae short, somewhat stout and blunt at apices; notopleural sutures complete. Mesonotum generally distinctly sculptured with transverse reticulation; with two pairs of campaniform sensillae. Metanotum generally distinctly sculptured with polygonal reticulation, with 10-12 discal setae. Foretibiae each with a small tooth.

Pelta (Fig. 13) distinct, widely trapezoidal, distinctly sculptured with transverse reticulation at posterior third, the rest generally sculptured with polygonal reticulation; with a pair of campaniform sensillae, their distance $92\text{ }\mu\text{m}$ in holotype. Abdominal terga sculptured with polygonal reticulation, but the reticles indistinct in intermediate terga. Terga II to V not reduced in length medially; B1 and B2 setae on tergum IX short and blunt at apices. Tube a little shorter than head, 0.94 times as long as head in holotype, about 1.6 times as long as maximum width; sides rather straight; dorsal surface almost smooth or very weakly reticulated, ventral surface weakly reticulated.

Measurements of holotype apterous female in μm . Total distended body length about 1300. Head whole length 100, length from anterior margin of eyes

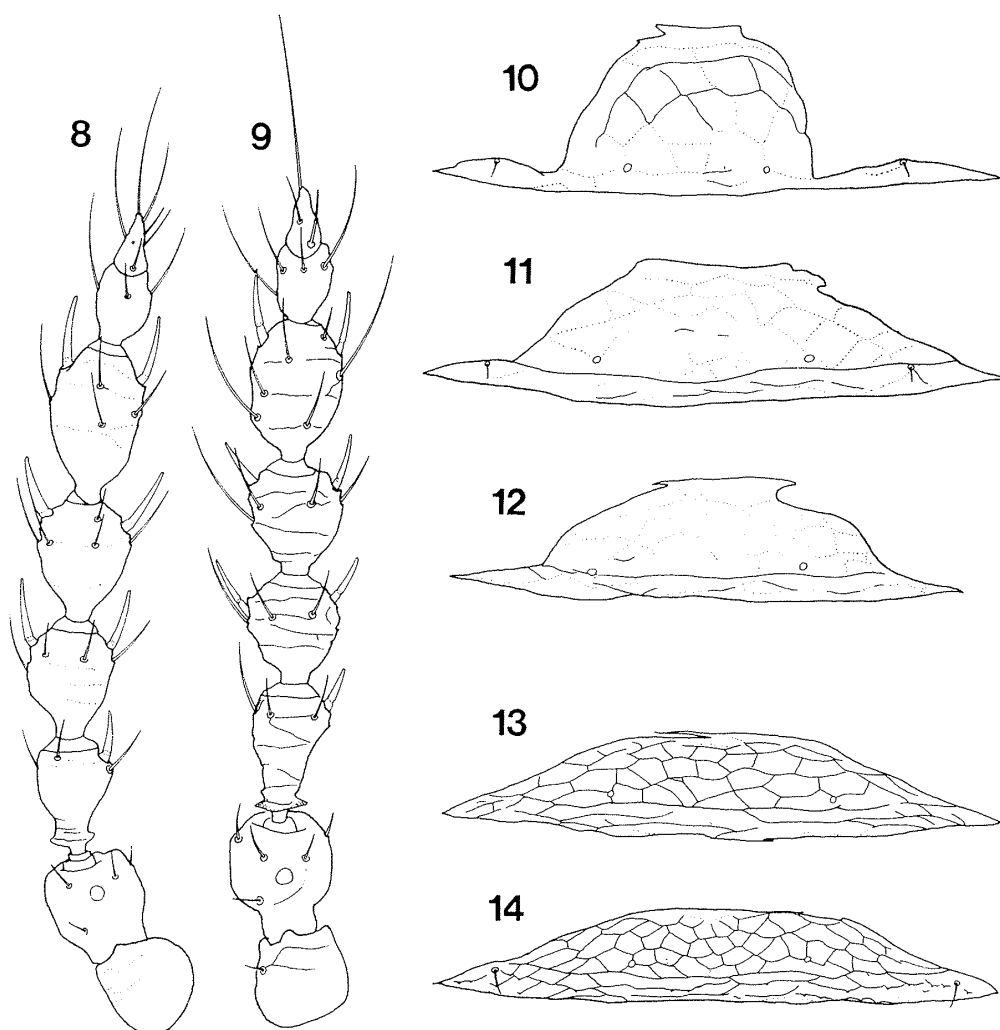


Figs. 6-7. *Sophiothrips decorus* sp. nov., large apterous male. — 6, Head, prothorax and right foreleg; 7, abdominal segment IX and tube.

87, width across cheeks 127, across base 129; eye length 46, width 34. Pronotum median length 162, width 219. Pelta median length 42, width 229. Tube length 94, basal width 59, apical width 26. Antenna total length 284; segments I to VII+VIII length (width) as follows: 34 (29); 34 (34); 42 (27.5); 34 (30); 37 (31); 47 (31); 45 (18.5).

Length of setae. Ocellars 14-19; postoculars 20-22. Prothoracic anteroangulars about 10, anteromarginals 13-15, midlaterals about 20, posteroangulars 20-22, epimerals 18-19. Setae on tergum IX: B1 31-32, B2 29-32. Anals 50-55.

Male (aptera). Very similar in colour to apterous female. Head (Figs. 5-6) 1.1-1.2 times as broad as long, with a well developed tubercle ventrally between eyes, but the tubercle absent in small male; length/width of antennal segments (small-large males)=III 1.38-1.69, IV 1.09-1.48, V 1.23-1.50, VI 1.56-1.94, VII+VIII 2.47-2.58; prothorax well developed, with distinct median longitudinal line in large male (Fig. 6); forelegs enlarged in large male, foretibiae each with a stout



Figs. 8-14. Right antennae (8-9), and peltae (10-14) of *Sophiothrips* spp., females. — 8, *S. annulatus* sp. nov.; 9, *decorus* sp. nov. — 10, *S. annulatus* sp. nov., macropterous female; 11, *annulatus* sp. nov., apterous female; 12, *annulatus* sp. nov., apterous male; 13, *decorus* sp. nov., apterous female; 14, *decorus* sp. nov., large apterous male.

tooth; tergum IX with a stout median tubercle (Fig. 7); tube almost as long as head or a little longer, 1.49-1.50 times as long as maximum width.

Measurements of small-large paratype apterous males in μm . Total distended body length 986-1325. Head whole length 92-110, length from anterior margin of eyes 79-92, width across cheeks 110-119, across basal collar 110-121; eye length 40-42, width 32-34. Pronotum median length 140-224, width 185-246. Pelta median length 26-39, width 198-238. Tube length 79-94, basal width 53-62.5, apical width 23-26. Antenna total length 256-316; segments I to VII+VIII length (width) as follows: 31-39 (29-34); 32-36 (30-33); 34.5-45.5 (25-27); 29.5-40 (27-27); 34.5-42 (28-28); 42-52.5 (27-27); 42-49 (17-19).

Length of setae. Ocellars 15–24; postoculars 18–28. Prothoracic anteroangulars 14–28, anteromarginals 18–18, midlaterals 21–28, posteroangulars 21–35, epimerals 20–32. Setae on tergum IX: B1 31–33, B2 17–20. Anals 74–90.

Holotype ♀ (apt.). Japan, Ogasawara Isls., Haha-jima Is., Mt. Sakaigatake, on dead branches, 4–iii–1988, (SO).

Paratypes. Japan, Ogasawara Isls, Haha-jima Is.: 12 ♀ 5 ♂ (apt.), collected with holotype; nr. Minami-zaki, 6 ♀ 2 ♂ (apt.), on dead branches, 7 ♀ 2 ♂ (apt.), on grass, 5–iii–1988, (SO); nr. Nakanotaira, 3 ♀ 2 ♂ (apt.), on dead leaves, 6 ♀ 1 ♂ (apt.), on dead branches, 1 ♀ (apt.), on dead *Livistona chinensis* frond (Palmae), 7–iii–1988, (SO); 6 ♀ 1 ♂ (apt.), nr. Okimura, Mt. Chibusa-yama, on dead leaves, 9–iii–1988, (SO). Japan, Ogasawara Isls., Chichi-jima Is.: 5 ♀ 3 ♂ (apt.), Mt. Mikazuki-yama, on dead branches, on dead branches, 10–iii–1988, (SO); 1 ♂ (apt.), nr. Tokoyonotaki, on dead branches, 11–iii–1988, (SO); Mt. Asahi-yama, 4 ♀ 1 ♂ (apt.), on dead branches, 1 ♀ (apt.), on ever-green tree leaves (unidentified), 11–iii–1988, (SO).

Distribution. Japan—Ogasawara Islands (Haha-jima Is. and Chichi-jima Is.).

Comments. This species belongs to the group with bicoloured body, one outer sense-cone on the third antennal segment, ventral tubercle on head and median tubercle on ninth abdominal tergum in male. These combination of features are also found in *boltoni* (MOUND) from Java, *makaronesicus* (ZUR STRASSEN) from the Azores and Canary Islands, and *typicus* (ANANTHAKRISHNAN) from India. From *makaronesicus* which is most similar to *decorus*, it differs in paler sixth to eighth abdominal segments and mid- and hindtibiae, more distinct sculptures on head, thorax and abdominal terga, and subbasal annular expansion on the third antennal segment. From *boltoni* and *typicus*, it can easily be distinguished by the colour of abdomen and legs, and stouter sculptures on head, thorax and abdominal terga.

Sophiothrips nigrus ANANTHAKRISHNAN

Sophiothrips nigrus ANANTHAKRISHNAN, 1971, 197; MOUND & WALKER, 1982, 349; OKAJIMA, 1987, 552–554.

Nanothrips nigrus: MOUND, 1977, 180.

This species was originally described from India, and is known from the wide range of eastern Asia at the present. Moreover, there are some differences between local populations in the coloration in this species (see OKAJIMA, 1987), and there are two colour forms in the material collected from Japan. The specimens from Honshu, Kyushu and the Ryukyu Islands have the bodies largely dark brown, and they are very similar to the type-series from India. However, the specimens from the Ogasawara Islands have more yellowish bodies as the followings: Head and thorax yellowish brown, abdomen brownish yellow, tube yellow with apex dark; femora and tibiae yellow, shaded with dark brown medially; antennal segments I and II yellow, segments III to VI pale brown with bases yellow, segments VII and VIII greyish

brown. They are somewhat similar to the specimens from southern Sulawesi, Indonesia.

Material examined. Japan, Ogasawara Isls., Haha-jima Is.: 2 ♀ 1 ♂ (mac.) 1 ♂ (apt.), Mt. Sakaigatake, on dead branches, 4-iii-1988, (SO); nr. Minamizaki, 1 ♀ 1 ♂ (apt.), on grass, 3 ♀ (mac.) 2 ♀ 18 ♂ (apt.), on dead branches, 5-iii-1988, (SO); 1 ♀ (mac.) 2 ♀ 1 ♂ (apt.), nr. Okimura, Mt. Kensaki-yama, on dead branches, 6-iii-1988, (SO); 1 ♀ (mac.) 1 ♀ (apt.), Okimura, on dead leaves, 6-iii-1988, (SO); nr. Nakanotaira, 1 ♂ (apt.), on grass, 3 ♀ (mac.) 3 ♀ 8 ♂ (apt.), on dead branches, 7-iii-1988, (SO); 1 ♂ (apt.), Kitamura, on bamboo (*Pseudosasa japonica*), 7-iii-1988, (SO); 3 ♀ 1 ♂ (mac.) 2 ♀ 2 ♂ (apt.), nr. Okimura, Mt. Chibusa-yama, on dead leaves, 9-iii-1989, (SO). Japan, Ogasawara Isls., Chichi-jima Is.: 1 ♀ (mac.), Mt. Mikazuki-yama, on dead branches, 10-iii-1988, (SO); 1 ♀ (apt.), Mt. Asahi-yama, on dead branches, 11-iii-1988, (SO); 4 ♀ (mac.) 6 ♀ 13 ♂ (apt.), nr. Toko-yonotaki, on dead branches, 11-iii-1988, (SO). Japan, Ryukyu Isls., Okinawa-hontou Is.: 1 ♀ (apt.), Kunigami-son, nr. Yona, Ohkuni-rindou, on dead leaves and branches, 28-viii-1988, (SO); 1 ♀ 2 ♂ (apt.), Kunigami-son, Okuma, foot of Mt. Yonaha-dake, on dead *Casuarina* branches, 15-ix-1988, (SO); 1 ♀ (mac.), Onnason, Kenminnomori, on dead *Casuarina* branches, 18-ix-1988, (SO). Japan, Ryukyu Isls., Miyako-jima Is.: 2 ♂ (apt.), Nanamata-kaigan, on dead *Casuarina* branches, 7-iii-1990, (TN). Japan, Ryukyu Isls., Iriomote-jima Is.: 2 ♀ 1 ♂ (apt.), upper Riv. Urauchi, nr. Mariudonotaki, on dead *Arenga engleri* frond, 5-ix-1988, (SO); nr. Ohtomi, Nakamagawa-rindou, 1 ♀ (apt.), on dead *Arenga engleri* frond, 8-ix-1988, (SO), 1 ♀ (apt.), leaf-litter, 11-x-1989, (TN). Japan, Ryukyu Islands, Ishigaki-jima Is.: nr. Nagura, Takeda, on dead branches, 3 ♀ 1 ♂ (apt.), 7-ix-1989, 2 ♂ (apt.), 13-ix-1989, (TN et SO); Mt. Banna-dake, 31-viii-1989, 1 ♀ (mac.) 1 ♀ (apt.), on dead leaves, (TN et SO), 1 ♀ (apt.), on bamboograss, (TN); 1 ♀ (apt.), Tropic. Agr. Res. Ctr. Yaeyama Barnch, on dead *Casuarina* branches, 31-iii-1990, (TN). Japan, Kyushu: 1 ♀ (apt.), Saga-ken, Mt. Kishi-take, leaf-litter, 13-xi-1977, (TERAKAWA); 1 ♀ 2 ♂ (apt.), Fukuoka-ken, Mt. Tachibana, yellow pan trap, 16-vi-1979, (K. YAMAGISHI). Japan, Honshu: 1 ♂ (mac.), Nara-ken, Yagyu-kaidou, on dead branches, 11-viii-1980, (SO); 1 ♀. Kanagawa-ken, Zushi-shi, Jinmuji, on fern, 27-iv-1993 (SO). The author also examined several females and males from the following countries: Taiwan, Thailand, Singapore, Malaysia and Indonesia (see OKAJIMA, 1987).

Distribution. Japan—Honshu, Kyushu, Ryukyu Islands (Okinawa-hontou Is., Miyako-jima Is., Ishigaki-jima Is. and Iriomote-jima Is.) and Ogasawara Islands (Haha-jima Is. and Chichi-jima Is.); Taiwan; Thailand; Singapore; Malaysia; Indonesia; India.

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